

Discovering Burnt Island

Rationale

The Maine Department of Marine Resources has transformed the Burnt Island Light Station into an outstanding educational facility. The agency's Education Division utilizes this five-acre island to host numerous educational programs. *Discovering Burnt Island* will provide teachers with experiential learning in topics related to the State of Maine's marine environment and maritime history. All activities are aligned with the Maine Learning Results.

The course is available to educators of all grade levels and disciplines. It is a prerequisite for teachers wishing to participate in the overnight program for middle school students. Participants will become familiar with all of the activities, so that they can choose those that enhance their curriculum.

Primary Instructors

Elaine Jones, Education Director, Department of Marine Resources, W. Boothbay Harbor, ME
Aimee Hayden-Roderiques, Natural Science Educator, Department of Marine Resources
Jean McKay, Educator, Department of Marine Resources

Field Trips

Visit the Maine State Aquarium and the DMR research laboratory
Lobster boat, lobster dealer, and lobster pound

Class Schedule

The week-long residential course is based at the Burnt Island Light Station in Boothbay Harbor, Maine. Instruction will begin at 8:30 AM with activities continuing into the evening hours. Students are expected to complete reading assignments; participate in all classroom and field activities; engage in discussions; and complete a final project producing inquiry-based lesson plans.

Required Textbook

Marine Science by Thomas F. Greene, 2004
Abbie Burgess, Lighthouse Heroine by Dorothy Jones & Ruth Sargent, 1996
Glaciers & Granite, A Guide to Maine's Landscape & Geology by David L. Kendall, 1987

Required Readings

Sea Soup Phytoplankton by Mary Cerullo, 1999 and *Sea Soup Zooplankton* by Mary Cerullo, 2001

Evaluation Criteria

Pre & Post Tests (20%) will be administered using the Classroom Performance System.

Course Assignments (20%) will include readings prior to the course, readings during the evening hours, reflection questions, and written assignments.

Class participation (30%) will be evaluated based on the quality and consistency of contribution to the discussion forum.

Final Project (30%) will be the development of a unit comprised of inquiry-based lessons on a topic relevant to the course. The lessons will be made available to teachers, and the public on the Department of Marine Resources website.

Course Topics and Objectives

Day 1

Island Bingo

This activity is designed to acquaint teachers with Burnt Island. The players will roam around the five-acre island and locate the 24 items displayed on their card. Some of the items will be the historic buildings, while others will be island flora and fauna.

Gulf of Maine

A lecture and power-point presentation will introduce teachers to a unique body of water called the Gulf of Maine. Portions of this “sea beside the sea” were once considered the most productive fishing grounds in the world. Teachers will learn about the Gulf of Maine’s geologic history, physical features, watersheds, currents, tides, and fishing grounds. The region, and its resources, has been severely impacted over the years due to human population growth and development. Information will be shared about ongoing research and conservation efforts to save the Gulf of Maine.

Objectives

1. Locate the physical boundaries of the Gulf of Maine.
2. Identify the rivers that flow into the Gulf of Maine.
3. Understand reasons for productivity in the Gulf of Maine.
4. Locate which areas serve as popular inshore and offshore fishing grounds.
5. Demonstrate the concept of watersheds and how they connect to the Gulf of Maine.
6. Understand that water flowing through a watershed carries nutrients and pollutants.
7. Participate in an activity that demonstrates how harbors become polluted.
8. Learn about the work of the Gulf of Maine Ocean Observing System – GoMOOS

Coastal Habitats

Many types of habitats exist along the Coast of Maine with some easier to define than others. Substrate type, sediment grain size, water depth, temperature, waves, and tides all have a strong influence on the types of plants and animals that can inhabit a given place. Teachers will use a flow chart and dichotomous key to identify 18 different aquatic habitats found around the world. This activity, and the Gulf of Maine Marine Habitat Primer, will introduce the week’s activities and be great resources for the classroom.

Objectives

1. Classify 18 different types of aquatic habitats using cards that illustrate and describe each.
2. Utilize a dichotomous key as a tool to identify each aquatic habitat.
3. Utilize a flow chart as a tool to visualize the process of classifying each aquatic habitat.
4. Review the kinds of habitats that are common to the Coast of Maine.
5. Construct a habitat panorama adding the appropriate plants and animals to each setting – beach, rocky shore, and salt marsh.

Field Activity

Walk around the island and locate four distinct habitats: rocky shore, sand beach, mudflat, and maritime forest. Observe and describe the physical characteristics and identify flora and fauna associated with each habitat.

Evening Assignment

Read – *Sea Soup: Phytoplankton* and *Sea Soup: Zooplankton*, by Mary Cerullo

Participate in activities from the Sea Soup Teacher's Guide that acquaints learners with plankton.

Observe bioluminescent algae in the water after dark.

Day 2

Water Column

The water column is a dynamic environment with distinct layers that can be considered habitats unto themselves. Organisms living in the water column are attuned to physical changes and many migrate vertically to remain in favorable conditions. The Burnt Island dock will serve as a research platform where scientific instruments will be used for collecting samples and gathering environmental conditions.

Objectives

1. Utilize plankton nets to collect samples of zooplankton and phytoplankton.
2. Identify organisms using a field microscope and plankton guide.
3. Discuss the food chain and the ecological importance of plankton.
4. Determine the water's salinity, temperature, turbidity, water color, and dissolved oxygen.
5. Use a Van Dorn sampler to get water samples from different levels in the water column.
6. Use a bottom grab to collect sediment and examine the content.

Intertidal Zone

The rocky shore is an environment that is battered by surf, wind, and weather. The plants and the animals in the intertidal zone must withstand tidal fluctuations, frigid temperatures, extreme heat, and precipitation of all forms. Teachers will roam the zones, record the distribution of organisms, identify tide-pool inhabitants, and discover adaptations that allow plants and animals to survive.

Objectives

1. Learn about tidal forces, frequencies, and ranges experienced along the Maine coast.
2. Compare the high-energy rocky shore environment to the low-energy rocky shore.
3. Identify zones by determining the distribution of flora and fauna along a transect line
4. Compare the types of organisms living in each zone: splash, upper, middle and lower.
5. Discover how flora and fauna are adapted to environmental conditions of the intertidal zone.
6. Survey tide pools to determine size, temperature, salinity, and inhabitants.

Beach Study

Beaches are constantly in motion with their shape and size continuously shifting due to wind, waves, and weather. Teachers will examine the beach sand found on Burnt Island and compare it with sands from around the world. A hand-microscope, and other tools, will be used to determine the composition of the sand and the origin of its grains. A survey of life in and around the beach will be taken, plus a beach seine will be used to collect small fish and invertebrates near the shore.

Objectives

1. Survey the beach environment and discover the factors that influence this habitat.
2. Set-up a transect line from the water's edge to the shore and determine sediment size at each meter mark along the transect line.
3. Determine vegetation and animal counts inside quadrats along the transect line.

4. Examine the sand using a hand-held microscope and compare its composition to samples from other locations around the world.
5. Identify and count fish and invertebrates collected from a hand seine.
6. Compare the beach environment to that of the rocky shore.

Classification

The science of taxonomy will be introduced along with the phylogenic tree of life. Teachers will use dichotomous keys to classify animals and seaweeds found during their intertidal search. This activity will allow participants to become familiar with features used to group living things such as appendages, body covering, tentacles, pigment, structure, and symmetry.

Objectives

1. Review early systems of classification with attention paid to the system developed by Carolus Linnaeus.
2. Become familiar with the five-kingdom system of classification presently used.
3. Identify predominant characteristics and structural similarities of the collected specimens.
4. Use a dichotomous key to determine the phylum of each animal.
5. Use a dichotomous key to determine the species of each form of algae.

Evening Assignment

Read – *Abbie Burgess, Lighthouse Heroine*

Day 3

Navigation

Navigation is the art and science of finding where you are and how you can safely get to your next destination. The nautical chart offers a wealth of information to knowledgeable readers. Teachers will use a local chart to identify landmarks, find depths, measure distances, and plot a route using parallel rulers and dividers.

Objectives

1. Understand the symbols for landmarks, natural features, aids to navigation, dangers, channels, and other information found on a chart.
2. Use the compass rose, scale of miles, latitude-longitude lines, and navigational tools to determine direction and distance.
3. Plot a course from an offshore island into Boothbay Harbor.
4. Determine a position at sea by triangulation.

Compass Hike

The basic instrument used for finding directions on Earth is the compass. The use of a magnetic compass is simple; however most people do not know how to use one. Teachers will learn how to take compass bearings and how to determine the bearing of specified locations. After familiarizing themselves with the instrument, they will put their skills to work by participating in a compass hike to find a hidden treasure.

Objectives

1. Comprehend the basic principles associated with using a magnetic compass.

2. Understand the differences between true North and magnetic North.
3. Determine the direction of travel from a known bearing.
4. Maintain the correct direction of travel and navigate around obstacles towards a hidden treasure.

Mudflat Study

A wave-sheltered cove on Burnt Island reveals a mudflat at low tide. Teachers will examine the surface of this habitat in search of holes, pits, tracks, and castings produced by animals on the surface or burrowed in the mud. A clam hoe will be used to turn-over the mud. Participants will wash the sediment samples through a screen to locate, count, and identify species.

Objectives

1. Explore the mudflat area and make general observations of: appearance, odor, plant life, and animal life.
2. Determine how this location lends itself to the collection of sediment.
3. Locate burrow openings, castings, and tracks and determine how they were formed.
4. Set up a transect line and determine the population and diversity of infaunal species at designated locations along that line from the water's edge to the shore.
5. Scrape and observe a thin layer of surface mud under the microscope and describe its composition.
6. Identify and observe the types of worms living in the mudflat.
7. Discuss the baitworm industry and save some sandworms for recreational fishing.

Lighthouse Education

A tour of the restored buildings will take place, so that teachers can learn about the history of the Burnt Island Light Station. They will participate in a living history program where interpreters will portray life at the lighthouse as it was in 1950. A review of historic photographs, keeper's logbooks, and classroom activities will take place after the presentation.

Objectives

1. Learn about the history of lighthouses and their importance as aids to navigation.
2. Engage in a living history experience in order to understand the way of life for a lighthouse keeper, his wife, and children.
3. Interpret history through photographs taken at lighthouses along the coast of Maine.
4. Read logbook accounts to connect significant events, people, stories, and traditions with the historic site.
5. Understand the principles of optics through experiments that incorporate prisms, reflectors, and lenses.
6. Review the story of Abbie Burgess and discuss her acts of heroism at Matinicus Rock Lighthouse.

Evening Activity

GPS and Geocaching

Many people have heard of Global Positioning Systems (GPS) as a navigational tool, but few have used this technology. Teachers will learn how to use a hand-held GPS to navigate around the island to specific locations (coordinates of latitude and longitude) in an adventure hunt where tokens or caches are hidden. The activity will end with a discussion of the widespread uses of GPS.

Day 4

Sport-fishing

Many different sport-fish (mackerel, striped bass, pollock, flounder, etc.) can be caught off the shores of Burnt Island. A lesson on fishing techniques, regulations, and species identification will precede the activity of sport-fishing.

Objectives

- a. Learn about the anatomical features of fish, their behaviors, and preferred habitats.
- b. Collect bait by digging for marine worms and clams, and collecting mussels.
- c. Examine different types of recreational fishing gear and practice casting.
- d. Understand rules and regulations pertaining to saltwater species.
- e. Attend a lecture describing recreational fishing effort, its impact on marine species and its economic importance to the State of Maine.

Field Experience

Participants will experience recreational fishing off from Burnt Island. Mackerel, flounder, and Pollack will be the targeted species off the dock, while Striped Bass fishing will take place off from the island's rocky peninsulas

Marine Fisheries

The history of Maine's fisheries will be discussed from the 1600's to present-day, including aquaculture operations along our coast. Teachers will learn about the fishing techniques used to harvest groundfish, herring, lobsters, shrimp, scallops, and urchins. They will also learn about the overexploitation of the fisheries and current management practices in effect to rebuild the stocks.

Objectives

- a. Observe anatomical features, adaptations, and behaviors of marine life
- b. Identify commercially harvested fish and invertebrates exhibited at the Aquarium.
- c. View a power-point presentation of the following fishing industries: herring, sea cucumber, sea urchin, and aquaculturally grown mussels, oysters, and salmon.
- d. Review commercial catch statistics over the past 50 years and graph the results.
- e. Learn about the methods and tools of fishing by examining diagrams and models.
- f. Participate in the activity called "Grandma's Catch" to stimulate discussion related to fishing issues: overfishing, conservation practices, and management of the resources.

Field Trip

Participants will visit the Maine State Aquarium located at the Department of Marine Resources Fisheries Laboratory.

Remote Operated Vehicle (ROV) Demonstration

Teachers will observe the use of an ROV used by the department's scientists to conduct research. Connected to a video monitor, the ROV will bring the underwater world to the surface with stunning views of life on the dock pilings, in the water column, and on the bottom. Participants will then build their own ROV's using kits of pre-made parts and fly them in a large tank in the DMR wet lab.

Objectives

- a. Understand how the use of an ROV contributes to scientific research, underwater studies, and commercial applications.

- b. Design and build a small-scale, fully-functional ROV from home-made kits.
- c. Operate the ROV successfully around a tank and complete designated tasks.

Lobster Fishery

Ever since early settlers first learned from the Indians how to utilize the lobster, it has been Maine's most prized crustacean. Information about the well-documented lobster fishery can easily be integrated into multiple classroom disciplines. Interesting topics of study include: the biology, anatomy, and behavior of the lobster; the economics and management of the industry; and the culture and folklore surrounding lobsters and lobstermen. Participants will receive extensive information about the lobster fishery including the opportunity to meet a lobster biologist and a lobsterman.

Objectives

- a. Understand the history of lobstering through photographs and historic accounts.
- b. Learn about lobster gear and modifications of vessels, traps, and tools.
- c. Observe anatomical features and behavioral responses of a lobster.
- d. Meet lobster scientist Carl Wilson for a lecture and discussion of fishery status, catch versus effort, conservation and management practices, shell disease, and whale entanglement.
- e. Visit a lobster dealer and a lobster pound.

Field Experience

Participants will become lobstermen after boarding the "Hunky Dory." The unique hands-on experience will be extremely memorable as teachers participate in the process of hauling and baiting traps, measuring and banding lobsters, and listening to the tall tales of Dan-Dan the Lobsterman.

Evening Assignment

Lobster bake on Burnt Island to study the internal anatomy of Maine's prized crustacean.
Reading assignment – *Glaciers & Granite, A Guide to Maine's Landscape & Geology*

Day 5

Geologic History of Maine

Maine's geologic past is not hard to find, once you know where to look. Some of the important geological processes that have taken place over time will be reviewed in the classroom and then observed along Burnt Island's rocky shore. Maine was right on the scene of the action during continental collision, followed by a glacier, weathering, erosion, and deposition of sediments. These forces dramatically changed the Earth's surface creating our magnificent coastline.

Objectives

- 1. Review the time periods of Maine's geologic history
- 2. Learn about plate tectonics and understand how converging plates created our state's geologic features.
- 3. Understand the effects of glacial ice, weathering and erosion through simple hands-on activities and demonstrations.
- 4. Summarize Maine's geologic history.

Bedrock Geology

Fascinating information about the three basic rock types will be shared using a power-point presentation, geological maps, and hands-on activities. Teachers will analyze rock samples, determine mineral content, and classify them into their correct group: igneous, sedimentary, and metamorphic.

Objectives

1. Identify the distribution of bedrock and surficial materials in the State of Maine by using the geological maps: *Bedrock Geological Map of Maine* and *Surficial Geological Map of Maine*.
2. Learn about the three basic rock types by viewing photographic slides and studying rock samples.
3. Understand the value of geological maps in providing information for land-use, water-use, and resource-use decisions.
4. Analyze the textures of rocks and develop skills to identify mineral composition.

Rock Detectives

Teachers will become detectives looking for clues to help solve the mystery of the origin of Burnt Island. The clues are evidence of how rocks were formed, how they have changed, or how they found their way onto the island. Participants will conduct their own field observations before joining the instructor on a tour of study sites to verify and review the geological formations on Burnt Island.

Objectives

1. Roam Burnt Island to locate and record interesting geological features.
2. Use a field test kit to identify Burnt Island's rocks and minerals.
3. Create a geological map of the island and record locations using a GPS.
4. Tour the stations as a group for interpretation of Burnt Island's major geological formations.
5. Understand Burnt Island's origin and geologic past.

Week in Review

1. Post-test using the *eInstruction* Classroom Performance System.
2. Evaluation of Course
3. Assignment criteria for final project

Pack Up and Move Back to the Mainland